Environment and Natural Resources Trust Fund

2021 Request for Proposal

General Information

Proposal ID: 2021-089

Proposal Title: Sentinel Springs, Measuring Continuous Groundwater Response and Improvement

Project Manager Information

Name: John Barry

Organization: MN DNR - Ecological and Water Resources Division

Office Telephone: (651) 259-5660

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Project Basic Information

Project Summary: Real time monitoring of spring flow and chemistry is an inexpensive and innovative way to determine how groundwater quality responds to land use practices such as agricultural management.

Funds Requested: $183,000

Proposed Project Completion: 2023-06-30

LCCMR Funding Category: Small Projects (H)

Secondary Category: Water Resources (B)

Project Location

What is the best scale for describing where your work will take place?

Region(s): SE

What is the best scale to describe the area impacted by your work?

Region(s): SE, Metro,

When will the work impact occur?

In the Future

Narrative

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

Southeastern Minnesota's karst landscape makes aquifers particularly vulnerable to land use practices, which is evident from elevated levels of nitrate and pesticides in groundwater. Land use across the area is dominated by row crop agriculture, so collecting data that assist in determining which agricultural management practices are best for both the environment and farmers is needed.

Spring monitoring provides low cost and measurable indicators of what is happening under the land surface. In southeastern Minnesota, many springs respond quickly to changes in precipitation and land-use activity. Springs emerge from the same aquifers that maintain coldwater streams for trout habitat and provide water to homes and businesses. Understanding how spring flow and chemistry respond to agricultural management practices is critical for measurable improvement, as nutrients and pesticides that are lost from the field to aquifers equate to lost revenue for farmers.

The 2019 Groundwater Protection rule minimizes sources of nitrate pollution to the state's groundwater. The rule restricts fall application of commercial nitrogen fertilizer in vulnerable areas and outlines steps for nitrogen reduction for areas where it is elevated. Springs can be used as a surrogate for private drinking water and will help augment groundwater testing and evaluation.

What is your proposed solution to the problem or opportunity discussed above? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and Milestones.

These data will help identify the most sensitive aquifers and show how practices on the surface such as the timing of surface applications, planting of buffers, and planting of small grain, cover crops, and perennial crops impact groundwater. Outcomes will provide the data necessary for water management issues such as agricultural Best Management Practices evaluation, impaired water identification and remediation, trout stream management, groundwater protection and allocation issues, and local land and water management decisions.

The project proposes expanding data collection from a successful collaborative pilot project begun in spring 2017, which characterized precipitation responses at eight springs in southeastern Minnesota. Initial results indicated that following precipitation, spring water has varying responses that are dependent on the aquifer from which the spring emanates and surrounding land use. This project would expand monitoring by adding up to four new sites, increase the data collection frequency at specific sites, add pesticide screening for each spring, add project data to user friendly databases accessible to the public, and work with Soil Water Conservation Districts to disseminate findings.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

The DNR conducts groundwater and surface water monitoring across the state. However, outside of the pilot project, there isn't additional spring monitoring. The successful pilot project has shown that multiple collaborators use these data to better understand natural resource issues. This project will enhance fundamental understanding of groundwater characteristics, such as aquifer recharge and pollution sensitivity. The project will develop data necessary for groundwater protection, fisheries management, soil health assessments, impaired water identification, and local land and water management decisions. Farmers will benefit from these data by understanding when nutrient loss and timing impacts them the most.

Activities and Milestones

Activity 1: Expansion of spring monitoring network, database development, and report publication.

Activity Budget: $183,000

Activity Description:

Work with collaborative partners and identify up to four additional spring sites in different hydrogeologic units (aquifers) to include in the network (currently eight sites). Collect and analyze spring water samples. Collect continuous data at the sites, at 15 to 60 minute intervals. Maintain, download, and manage spring flow, spring temperature, nutrient, and chemistry data from each of the spring sites into a single database. Data will go through quality assurance and quality control steps and then be uploaded into state databases available to the public. Data will be analyzed and summarized in reports, including spring flow, temperature, response to precipitation and snowmelt, chemistry, and relationships to hydrogeology and land use.

Examples of recent reports and presentations using data collected in the pilot phase of the project are listed below.

- Report: Bear Spring https://conservancy.umn.edu/handle/11299/201602
- Report: Crystal Creek https://conservancy.umn.edu/handle/11299/201569
- Presentation: Nitrate Reduction Strategies https://conservancy.umn.edu/handle/11299/202271

Activity Milestones:

Description	Completion Date
Disseminate project data to farmers and public in cooperation with SWCD and UofM Extension	2023-06-30
Complete peer reviewed report(s) of aquifer recharge, nutrient transport, and agricultural management effectiveness	2023-06-30
Measure spring flow and chemistry, and develop spring level and flow curves	2023-06-30
Identify additional springs to monitor and collect and archive existing data into database	2023-06-30

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Justin Watkins & Jennifer Ender	Minnesota Pollution Control Agency	Expertise in continuous nitrate monitoring, field installation, and data acquisition.	Yes
Treeske Ehresmann or successor	Minnesota Department of Agriculture Laboratory Services	Laboratory Services- Determination of pesticide concentrations using MDA GC/MS/MS suite (40 analytes).	Yes
Kevin Kuehner	Minnesota Department of Agriculture	Providing in-kind assistance with data acquisition, land owner relations, and reporting.	No
Caitlin Brady & Martin Larsen	Olmsted County and Olmsted Soil & Water Conservation District	Analyze water samples and assist with data acquisition, land owner relations, and reporting.	Yes
Tony Runkel	Minnesota Geological Survey	Determine hydrogeologic units from which springs emerge and assist with data analysis and reporting.	Yes

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this be funded?

Project results will be shared and implemented through a combination of presentations with the agricultural community and local environmental managers, updated and publicly accessible databases, and peer reviewed report(s). Ongoing efforts may be funded through stakeholder collaborations and potentially additional Trust Fund support.

Project Manager and Organization Qualifications

Project Manager Name: John Barry

Job Title: Hydrologist 3

Provide description of the project manager's qualifications to manage the proposed project.

John Barry is a senior hydrologist at the Department of Natural Resources, with 16 years of experience in hydrology and project management. His current responsibilities include completing countywide aquifer-mapping projects that use geologic and geochemical data and geographic information systems (GIS) to create reports for water resource assessment and protection purposes. He also is involved in dye trace investigations, geophysical investigations, project review, project development, and project management within the County Geologic Groundwater Atlas group and routinely works with collaborative partners at the Minnesota Geological Survey, Minnesota Department of Agriculture, Minnesota Pollution Control Agency, county offices, and soil and water conservation districts. He received a B.S. in Geological Science, with an emphasis in hydrogeology from the University of Minnesota, Twin Cities.

John initiated the spring monitoring pilot project and has vast experience working with springs, karst, environmental monitoring, aquifer chemistry, and as a project manager. He will be responsible for providing overall project management and technical direction for the project, coordinating with project partners, contracting for professional

services in support of the project, directing the development of project reports and any other deliverables, and preparing and submitting project work plans, updates, and final reports.

Organization: MN DNR - Ecological and Water Resources Division

Organization Description:
The mission of the Minnesota DNR is to work with citizens to conserve and manage the state's natural resources, to provide outdoor recreation opportunities, and to provide for the commercial uses of natural resources in a way that creates a sustainable quality of life. The DNR has extensive experience administering and coordinating projects funded by the ENRTF.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
John Barry		Hydrologist 3			20%	0.8	X	$100,000
Holly Johnson		Research Analysis Specialist Sr.			20%	0.1	X	$5,220
Dan Cronquist		Hydrologist 1			20%	0.1	X	$9,100
							Sub Total	**$114,320**
Contracts and Services								
Minnesota Pollution Control Agency (MPCA)	Professional or Technical Service Contract	MPCA- Specialty Services includes continuous nitrate monitoring, field installation, equipment if needed, data acquisition, and data quality assurance.		X		0.2		$27,500
Minnesota Department of Agriculture Laboratory Services (MDA)	Professional or Technical Service Contract	The MDA laboratory conducts a low cost screening analysis of a pesticide suite using GC/MS/MS that includes 40 analytes. The MDA results go through rigorous QA/QC and are database ready, which minimizes staff time and the possibility of database entry errors.		X		0.02		$4,000
Minnesota Geological Survey (MGS)	Professional or Technical Service Contract	The MGS will assist with geologic interpretation, hydrostratigraphic analysis, hydrogeologic data synthesis and analysis, and project reporting.		X		0.1		$10,500
Olmsted County Public Health	Professional or Technical Service Contract	Olmsted County staff will assist with landowner access, public presentations, as agriculture liaisons, and with reporting.		X		0.1		$4,850
							Sub Total	**$46,850**
Equipment, Tools, and Supplies								

	Equipment	Flow measurement and flow logging tools and pressure transducers for measuring spring level(est $4,800 for flow meter and wading rod, est $4,950 for flow logging system, est $4,300 for four pressure transducers).	Pressure transducers measure water level and are necessary to understand spring flow response and flow. Flow meters are used to create a relationship between spring level and spring flow.					$9,250
							Sub Total	**$9,250**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	In-state vehicle mileage (est $2,560) and travel expenses (est $700), primarily for water sampling and field data collection.	Travel is required to install, maintain, and download data from equipment. All travel per DNR policy/commissioners plan.					$3,260
							Sub Total	**$3,260**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
		Direct and Necessary expenses: People Support (~$1,661), Safety Support (~$309), Financial Support (~$1,529), Communication Support (~$1,324), IT Support (~$3,348), and Planning Support (~$1,149) necessary to accomplish funded programs/projects.	Direct and Necessary expenses includes all Departmental Support Services					$9,320

							Sub Total	**$9,320**
							Grand Total	**$183,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Personnel - John Barry		Hydrologist 3	**Classified :** These positions will be canceled and the approved complement of the agency reduced accordingly once the appropriation has been spent.
Personnel - Holly Johnson		Research Analysis Specialist Sr.	**Classified :** These positions will be canceled and the approved complement of the agency reduced accordingly once the appropriation has been spent.
Personnel - Dan Cronquist		Hydrologist 1	**Classified :** These positions will be canceled and the approved complement of the agency reduced accordingly once the appropriation has been spent.
Contracts and Services - Minnesota Pollution Control Agency (MPCA)	Professional or Technical Service Contract	MPCA- Specialty Services includes continuous nitrate monitoring, field installation, equipment if needed, data acquisition, and data quality assurance.	As a State Agency, the MPCA is given preference for this contract. In addition, the MPCA is an existing pilot project collaborator with unique technical experience in installing and operating continuous nitrate monitoring equipment and managing continuous nitrate data. **This is a single source contract.**
Contracts and Services - Minnesota Department of Agriculture Laboratory Services (MDA)	Professional or Technical Service Contract	The MDA laboratory conducts a low cost screening analysis of a pesticide suite using GC/MS/MS that includes 40 analytes. The MDA results go through rigorous QA/QC and are database ready, which minimizes staff time and the possibility of database entry errors.	As a State Agency, the MDA is given preference for this contract **This is a single source contract.**
Contracts and Services - Minnesota Geological Survey (MGS)	Professional or Technical Service Contract	The MGS will assist with geologic interpretation, hydrostratigraphic analysis, hydrogeologic data synthesis and analysis, and project reporting.	The MGS is the premier source for geologic interpretation and hydrostratigraphic analysis for Minnesota and as a state entity, the University of Minnesota Is given preference for this work. **This is a single source contract.**
Contracts and Services - Olmsted County Public Health	Professional or Technical Service Contract	Olmsted County staff will assist with landowner access, public presentations, as agriculture liaisons, and with reporting.	County staff have unique working relationships with landowners and farmers and have built trust over many years of working together. These unique relationships are essential for conveying project data to the agricultural community. Contract money can be spent on staff time related to landowner relations, public presentations, and reporting. **This is a single source contract.**

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	**-**
Non-State				
In-Kind	Funding from DNR, MPCA, Olmsted County, and MDA	Development of pilot project, pilot project equipment, partner specialty services, water analysis, field and equipment installation and maintenance, data collection, and reporting.	Secured	$65,000
			Non State Sub Total	**$65,000**
			Funds Total	**$65,000**

Attachments

Required Attachments

Visual Component

File: df9d1f49-be4.pdf

Alternate Text for Visual Component

The graphic outlines facts about springs, describes the project purpose and outcomes, includes a map of the locations of springs in southeast Minnesota that were monitored in the pilot project, and shows an example of data collected from pilot project.

Optional Attachments

Support Letter or Other

Title	File
Sentinel Springs Support Letter from UofM Extension Educator Greg Klinger	a9d372ef-400.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Does your project have patent, royalties, or revenue potential?

No

Does your project include research?

Yes

Does the organization have a fiscal agent for this project?

No

Sentinel Springs, Measuring Continuous Groundwater Response and Improvement

John Barry, Minnesota DNR

Springs facts

- defined as locations where focused water emerges from the ground
- provide critical flow to trout streams
- flow and chemistry differs between aquifers and land use

Purpose of monitoring springs

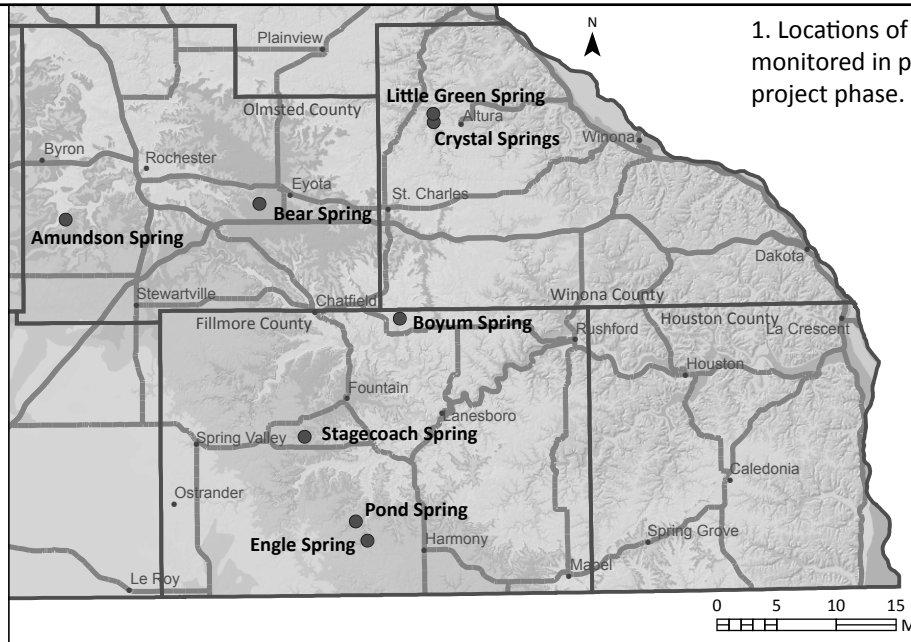
Determine:

- groundwater and surface water interaction
- aquifer recharge and chemistry
- how changes in agricultural land management can protect water quality

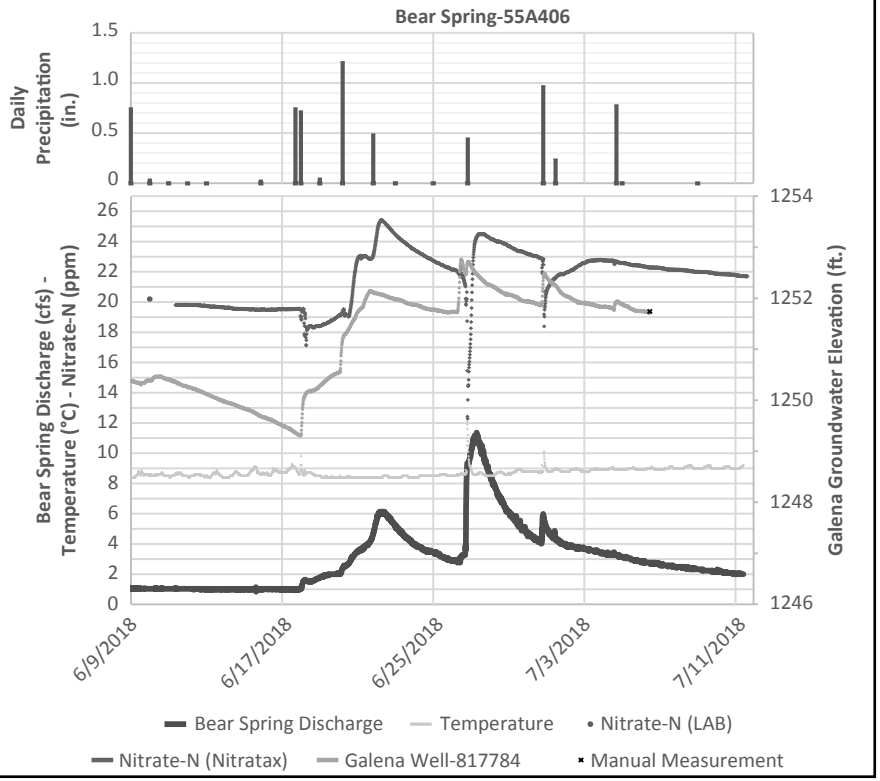
Project outcomes

Provide the data and analyses necessary for water, land, and resource management issues such as:

- assessing agricultural Best Management Practices (BMPs)
- groundwater protection
- trout stream, fisheries, and watershed management
- impaired water identification and remediation



1. Locations of springs monitored in pilot project phase.



2. Spring hydrograph and chemograph responses to recharge events (precipitation) at pilot project spring.